

# PATENT ABSTRACTS OF JAPAN

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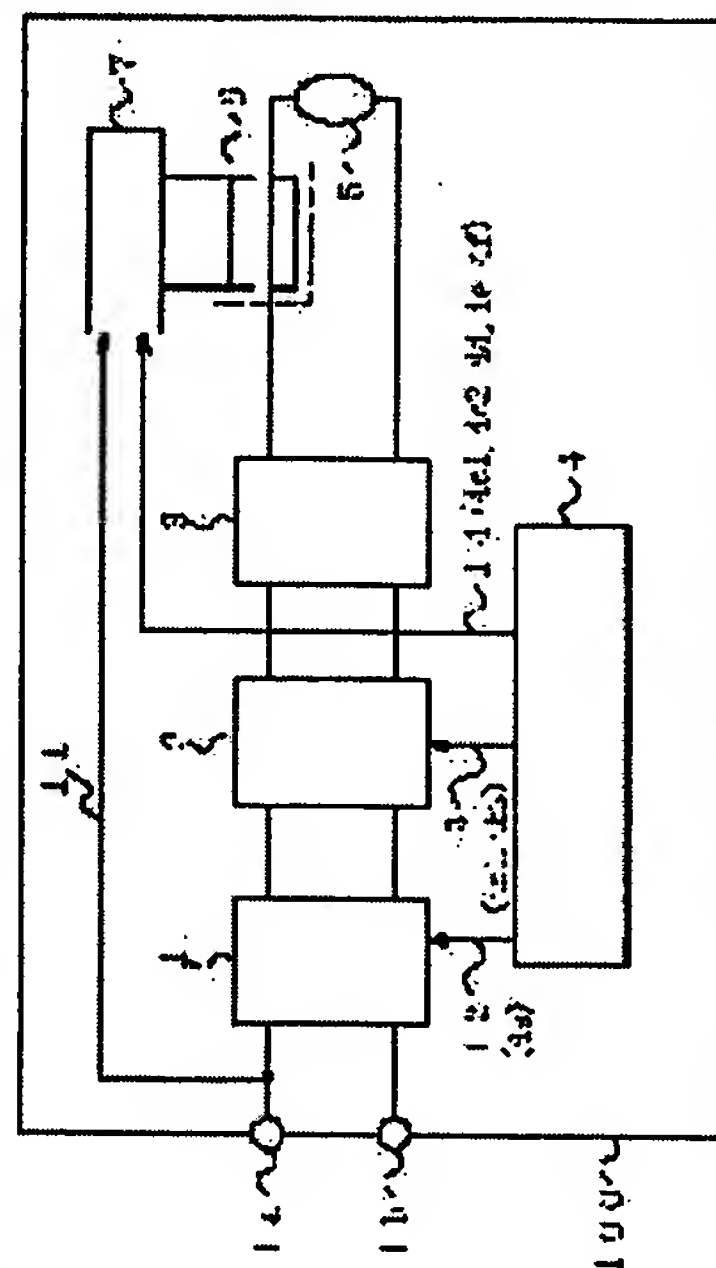
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## (54) ALTERNATING CURRENT BALLAST DEVICE AND ITS CONTROLLING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an alternating current ballast device increasing an electrode temperature without any increase of electric power by superposing of a high frequency electric current.

SOLUTION: This alternating current ballast is provided with a lamp 5, a step-down chopper 1 performing conversion to a lamp voltage, a full-bridge switching circuit 2 feeding an alternating voltage to the lamp 5, an ignitor 3 generating a high voltage for starting discharge, a high frequency transformer 6 superposing a high frequency voltage over an output from the full-bridge switching circuit 2, a high frequency power source 7 feeding the high frequency voltage to a primary side of the high frequency transformer 6, and a control circuit 4 controlling the full-bridge switching circuit 2 and the high frequency power source 7, respectively. In synchronization with a signal switching the full-bridge switching circuit 2, the high frequency power source 7 connected to the primary side of the high frequency transformer 6 is driven, and consequently, the high frequency voltage is superposed.



1: ステップダウンチョッパ  
2: フルブリッジスイッチング回路  
3: イグナイタ  
4: 制御回路  
5: ランプ  
6: 高周波変圧器  
7: 高周波電源

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3. In the drawings, any words are not translated.

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**CLAIMS**

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[Claim(s)]

[Claim 1] A lamp and the pressure-lowering chopper changed into the lamp voltage which should control the inputted direct current voltage, The full bridge switching circuit which receives the output voltage of said pressure-lowering chopper, and supplies alternating voltage to said lamp, The ignitor which generates the high voltage for destroying an insulation of said lamp and making discharge start, The high frequency transformer which makes high-frequency voltage superimpose on the output of said full bridge switching circuit, The RF generator which supplies high-frequency voltage to a primary said high frequency transformer side, Alternating current ballast equipment characterized by having the control circuit which controls the output voltage of said pressure-lowering chopper, and controls each of said full bridge switching circuit and said RF generator, and superimposing high-frequency voltage on the alternating voltage of said lamp.

[Claim 2] Alternating current ballast equipment according to claim 1 which superimposes high-frequency voltage on direct current voltage at the time of no-load [ of said lamp ] at the time of said lamp discharge starting.

[Claim 3] Alternating current ballast equipment according to claim 1 which starts said lamp discharge and superimposes high-frequency voltage on the alternating voltage of said lamp after that.

[Claim 4] Said high frequency transformer and said RF generator are alternating current ballast equipment according to claim 1, 2, or 3 which is formed between said ignitors and said lamps, drives said RF generator connected to the primary said high frequency transformer side synchronizing with the signal which switches said full bridge switching circuit, and superimposes high-frequency voltage on said lamp voltage.

[Claim 5] Said high-frequency voltage is claims 1, 2, and 3 which are the continuous high-frequency voltage, or alternating current ballast equipment of 4 \*\*.

[Claim 6] A lamp and the pressure-lowering chopper changed into the lamp voltage which should control the inputted direct current voltage, The full bridge switching circuit which receives the output voltage of said pressure-lowering chopper, and supplies alternating

voltage to said lamp, The ignitor which generates the high voltage for destroying an insulation of said lamp and making discharge start, The high frequency transformer which makes high-frequency voltage superimpose on the output of said full bridge switching circuit, The RF generator which supplies high-frequency voltage to a primary said high frequency transformer side, It is the control approach of alternating current ballast equipment equipped with the control circuit which controls the output voltage of said pressure-lowering chopper, and controls each of said full bridge switching circuit and said RF generator. In case said lamp is turned on, the high frequency current is superimposed at a rate which has a half period in the location of the arbitration of the half period of 1 of said lamp current. The control approach of alternating current ballast equipment that other half periods of said lamp current are characterized by superimposing the high frequency current on the location of the arbitration of other half periods of said lamp current at a predetermined rate of a half period.

[Claim 7] Said location is the control approach of the alternating current ballast equipment according to claim 6 which is the back end section of the half period of 1 of said lamp current, and is the back end section of other half periods of said lamp current.

[Claim 8] The control approach of the alternating current ballast equipment according to claim 7 characterized by superimposing the high frequency current also on the front end section of the half period of 1 of said lamp current at a predetermined rate of a half period, and other half periods of said lamp current superimposing the high frequency current also on the front end section of other half periods of said lamp current at a predetermined rate of a half period in case said lamp is turned on.

[Claim 9] A lamp and the pressure-lowering chopper changed into the lamp voltage which should control the inputted direct current voltage, The full bridge switching circuit which receives the output voltage of said pressure-lowering chopper, and supplies alternating voltage to said lamp, The ignitor which generates the high voltage for destroying an insulation of said lamp and making discharge start, The high frequency transformer which makes high-frequency voltage superimpose on the output of said full bridge switching circuit, The RF generator which supplies high-frequency voltage to a primary said high frequency transformer side, It is the control approach of alternating current ballast equipment equipped with the control circuit which controls the output voltage of said pressure-lowering chopper, and controls each of said full bridge switching circuit and said RF generator. The control approach of the alternating current ballast equipment characterized by superimposing the high frequency current at a rate which has a half period in the location of the arbitration of the half period when said lamp current does not continue in case said lamp is turned on.

[Claim 10] The control approach of alternating current ballast equipment given in any 1 term according to claim 6 to 9 which the frequency of the high frequency current

superimposed on said lamp current is 20kHz or more, and is a frequency except the acoustic resonance frequency of said lamp in case said lamp is turned on.

[Claim 11] The wave height of the high frequency current superimposed on said lamp current in case said lamp is turned on is the control approach of alternating current ballast equipment given in any 1 term according to claim 6 to 10 whose superposition time amount it is 0.9 or less [ of the mean amplitude of basic alternating current ], and is 1/4 or less [ of a half period ].

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to the alternating current ballast equipment which turns on the high-pressure mercury lamp used for a projector about alternating current ballast equipment.

[0002]

[Description of the Prior Art] Since the projector which makes a liquid crystal method the start can use it easily in recent years, it is the well-known fact which the application has expanded. Generally the alternating current ballast equipment which turns on the high-pressure mercury lamp used for this projector is also known well.

[0003] Generally the approach of controlling a current wave form as a means to reduce a flicker (for it to also be called the flicker of an arc) of the brightness of an above-mentioned mercury lamp (an alternating current lamp is called henceforth) is also common knowledge. A means to reduce a flicker of the brightness of such an alternating current lamp is indicated by for example, the Patent Publication Heisei No. 501919 [ ten to ] official report.

[0004] That is, by superimposing pulse current on the back end of an alternating current lamp current signal wave form, and raising the electrode temperature of an alternating current lamp, the radix point of the arc at the time (it is called alternation) of a current changing is fixed, and a flicker is lost.

[0005] When electrode temperature is made high in front of the alternation of alternating current, an arc is stabilized by even after lamp current alternation and a flicker can be reduced.

[0006] The thing of the conventional well-known technique superimposes pulse current on the back end of alternating current in alternating current and this direction.

[0007]

[Problem(s) to be Solved by the Invention] However, with conventional alternating current ballast equipment, the mean power supplied to a lamp becomes high, and there is evil which shortens the life of a lamp.



[0008] Moreover, since the pulse current value to superimpose is fixed, a supply voltage becomes high proportionally and it also has the problem which will accelerate compaction of a life as lamp voltage becomes high.

[0009] Therefore, the purpose of this invention is to offer the alternating current ballast equipment which reduced these problems in view of the above-mentioned problem.

[0010] This invention can make electrode temperature high without the increment in power by superimposing the high frequency current instead of direct-current pulse current.

Consequently, reduction of a flicker is realizable. Moreover, it has effectiveness also to the fall of an electrical potential difference with the same configuration of this invention at the time of an IGUNAITO electrical potential difference and no-load.

[0011]

[Means for Solving the Problem] The pressure-lowering chopper changed into the lamp voltage by which the alternating current ballast equipment of this invention should control the direct current voltage into which the lamp was inputted, The full bridge switching circuit which receives the output voltage of said pressure-lowering chopper, and supplies alternating voltage to said lamp, The ignitor which generates the high voltage for destroying an insulation of said lamp and making discharge start, The high frequency transformer which makes high-frequency voltage superimpose on the output of said full bridge switching circuit, The RF generator which supplies high-frequency voltage to a primary said high frequency transformer side, It is the configuration which is equipped with the control circuit which controls the output voltage of said pressure-lowering chopper, and controls each of said full bridge switching circuit and said RF generator, and superimposes high-frequency voltage on the alternating voltage of said lamp.

[0012] Furthermore, the alternating current ballast equipment of this invention is a configuration which superimposes high-frequency voltage on direct current voltage at the time of no-load [ of said lamp ] at the time of said lamp discharge starting.

[0013] Furthermore, the alternating current ballast equipment of this invention starts said lamp discharge, and is a configuration which superimposes high-frequency voltage on the alternating voltage of said lamp after that.

[0014] Furthermore, said high frequency transformer and said RF generator of alternating current ballast equipment of this invention are a configuration which is prepared between said ignitors and said lamps, drives said RF generator connected to the primary said high frequency transformer side synchronizing with the signal which switches said full bridge switching circuit, and superimposes high-frequency voltage on said lamp voltage.

[0015] Furthermore, said high-frequency voltage of the alternating current ballast equipment of this invention is the configuration of the continuous high-frequency voltage.

[0016] Furthermore, the control approach of the alternating current ballast equipment of this invention A lamp and the pressure-lowering chopper changed into the lamp voltage which

should control the inputted direct current voltage, The full bridge switching circuit which receives the output voltage of said pressure-lowering chopper, and supplies alternating voltage to said lamp, The ignitor which generates the high voltage for destroying an insulation of said lamp and making discharge start, The high frequency transformer which makes high-frequency voltage superimpose on the output of said full bridge switching circuit, The RF generator which supplies high-frequency voltage to a primary said high frequency transformer side, It is the control approach of alternating current ballast equipment equipped with the control circuit which controls the output voltage of said pressure-lowering chopper, and controls each of said full bridge switching circuit and said RF generator. In case said lamp is turned on, it is the configuration that superimpose the high frequency current at a rate which has a half period in the location of the arbitration of the half period of 1 of said lamp current, and other half periods of said lamp current superimpose the high frequency current on the location of the arbitration of other half periods of said lamp current at a predetermined rate of a half period.

[0017] Further again said location of the control approach of the alternating current ballast equipment of this invention Again to the pan which is the configuration which is the back end section of the half period of 1 of said lamp current, and is the back end section of other half periods of said lamp current the control approach of the alternating current ballast equipment of this invention In case said lamp is turned on, it is the configuration that superimpose the high frequency current also on the front end section of the half period of 1 of said lamp current at a predetermined rate of a half period, and other half periods of said lamp current superimpose the high frequency current also on the front end section of other half periods of said lamp current at a predetermined rate of a half period.

[0018] In case the control approach of the alternating current ballast equipment of this invention turns on said lamp, it is a configuration characterized by superimposing the high frequency current at a rate which has a half period in the location of the arbitration of the half period when said lamp current does not continue further again.

[0019] In case the control approach of the alternating current ballast equipment of this invention turns on said lamp, it is a configuration which the frequency of the high frequency current superimposed on said lamp current is 20kHz or more, and is a frequency except the acoustic resonance frequency of said lamp further again.

[0020] And in case the control approach of the alternating current ballast equipment of this invention turns on said lamp, the wave height of the high frequency current superimposed on said lamp current is the configuration that it is 0.9 or less [ of the mean amplitude of basic alternating current ], and superposition time amount is 1/4 or less [ of a half period ] again.

[0021]

[Embodiment of the Invention] Next, the gestalt of operation of this invention is explained, referring to a drawing. Drawing 1 is the block diagram of the alternating current ballast

equipment of the gestalt of operation of the 1st of this invention.

[0022] When drawing 1 is referred to, the alternating current ballast equipment 100 of the gestalt of operation of the 1st of this invention A lamp 5 and the pressure-lowering chopper 1 changed into the lamp voltage which should control the inputted direct current voltage, The full bridge switching circuit 2 which receives the output voltage of the pressure-lowering chopper 1, and supplies alternating voltage to a lamp 5, The ignitor 3 which generates the high voltage for destroying an insulation of a lamp 5 and making discharge start, The high frequency transformer 6 which makes high-frequency voltage superimpose on the output of the full bridge switching circuit 2, RF generator 7 which supplies high-frequency voltage to a primary a high frequency transformer 6 side, It has the control circuit 4 which controls the output voltage of the pressure-lowering chopper 1, and controls each of the full bridge switching circuit 2 and RF generator 7. A high frequency transformer 6 and RF generator 7 It is the configuration which superimposes high-frequency voltage (\*\*) on lamp voltage (\*\*) by driving RF generator 7 connected to the primary a high frequency transformer 6 side synchronizing with the signal which is established between an ignitor 3 and a lamp 5 and switches the full bridge switching circuit 2.

[0023] Next, if drawing 2 is referred to, the pressure-lowering chopper 1 of the alternating current ballast equipment of the gestalt of operation of the 1st of this invention will possess FET21, the flywheel diode 22, a choke coil 23, and a capacitor 24, and will operate by the duty (duty is not shown in drawing) by output-signal 4a whose FET21 is a pressure-lowering chopper actuating signal at the time of lamp lighting of a control circuit 4.

[0024] Next, if drawing 3 is referred to, the full bridge switching circuit 2 of the alternating current ballast equipment of the gestalt of operation of the 1st of this invention is constituted by carrying out parallel connection of FET (31 32) connected to the serial, and FET (33 34) connected to the serial, and only FET31 and FET34 of tucking up their sleeves with a cord turn it on at the time of lamp lighting initiation.

[0025] Next, actuation of the alternating current ballast equipment of the gestalt of operation of the 1st of this invention is explained.

[0026] If drawing 1 , drawing 4 , and drawing 5 are combined and referred to, direct current voltage will be supplied to the input terminal (1a, 1b), and the pressure-lowering chopper 1 of the alternating current ballast equipment of the gestalt of operation of the 1st of this invention will start the actuation by pressure-lowering chopper actuating signal 4a at the time of lamp lighting of a control circuit 4.

[0027] The pressure-lowering chopper 1 operates by the duty (duty is not shown in drawing) according [ FET21 shown by drawing 2 ] to pressure-lowering chopper actuating signal 4a the time of lamp lighting of a control circuit 4, and the output voltage of the pressure-lowering chopper 1 turns into direct current voltage according to this duty.

[0028] The output voltage of the pressure-lowering chopper 1 becomes almost equal to the

electrical potential difference applied to input terminals 1a and 1b, and calls this no-load voltage until a lamp 5 discharges.

[0029] Moreover, at the time of lamp lighting initiation, by the signal four b1 of drawing 4, since only FET31 and FET34 of tucking up their sleeves with a cord are turned on, as for the full bridge switching circuit 2, an electrical potential difference is outputted at the time of direct-current no-load, as for the output of the full bridge switching circuit 2. If RF generator 7 is driven synchronizing with output signal 4a of drawing 4 at this time, as shown in RF superposition section 51 of superposition wave 5a of drawing 5 a, high-frequency voltage will be impressed further.

[0030] The high frequency current can be superimposed on a lamp current by forming a high frequency transformer 6 between an ignitor 3 and a lamp 5, and driving a high frequency transformer 6 by RF generator 7 which drives a high frequency transformer 6 at the time of lamp lighting and stationary actuation.

[0031] Furthermore, when the lamp 5 is not on, a pulse voltage joins an ignitor 3 from a pulse generating circuit (not shown), the high voltage occurs in the output of an ignitor 3, it is superimposed on this electrical potential difference at the period of RF superposition section 51a of superposition wave 5a of drawing 5, and a lifting and discharge shift dielectric breakdown in a lamp 5 to arc discharge.

[0032] If it shifts to arc discharge, it operates by the fixed direct current, and if actuation is stabilized, alternating current control will be carried out, and a lamp will move to the gestalt of implementation of the 2nd of invention mentioned later further until actuation of a lamp 5 is stabilized.

[0033] Moreover, alternating current is impressed to a lamp 5 by turning on FET (31 34) and FET (32 33) of tucking up its sleeves with a cord for all by turns at the time of a lamp stationary point LGT. FET (31 34) and FET (32 33) are controlled by one tucking-up-their-sleeves-with-a-cord actuating signal four b1 of the full bridge switching circuit from a control circuit 4, and the tucking-up-their-sleeves-with-a-cord actuating signal four b2 of another side of a full bridge switching circuit, respectively.

[0034] Generally, the time amount by which actuation of a lamp 5 is stabilized is prescribed by the time amount T of superposition wave 5a shown in drawing 5.

[0035] Next, the control approach of the alternating current ballast equipment of the gestalt operation of the 2nd of this invention is explained.

[0036] 5b of drawing 5 or subsequent ones shows the wave of the alternating current ballast equipment of the gestalt of operation of the 2nd of this invention of operation.

[0037] Wave 5b of drawing 5 is what superimposed the high frequency current on the back end of the half period of a lamp current, and operates RF generator 7 with the RF generator driving signal (4c1, 4c2) which superimposes the RF of a control circuit 4 on the back end.

[0038] Wave 5c of drawing 5 superimposes the high frequency current on the tip and the back



end of a half period of a lamp current. In this case, RF generator 7 is operated by 4d of RF generator driving signals which superimpose the RF of a control circuit 4 at the back end and the tip of a half period.

[0039] Moreover, 5d of waves of drawing 5 superimposes the high frequency current on the location of the arbitration of the half period of a lamp current. In this case, RF generator 7 is operated in RF generator driving signal 4e which superimposes the RF of a control circuit 4 on the location of arbitration.

[0040] Wave 5e of drawing 5 keeps not the lamp current that continued the high frequency current but one or more spacing, and superimposes it on the location of the arbitration of a half period further again. In this case, RF generator 7 is operated by 4f of RF generator driving signals which superimpose the RF of a control circuit 4 on the location of arbitration at intervals of one.

[0041] If the frequency of the current to superimpose is 20kHz or less in audio frequency, vibration of a transformer etc. must become jarring in acoustic sense, and, for a failure \*\*\*\*\* reason, actuation on the acoustic resonance frequency of a lamp proper must avoid these frequencies to a lamp property.

[0042] Moreover, when the peak value of the high frequency current to superimpose is large, the minimum current also becomes low and discharge stops. For this reason, the wave height of the high frequency current to superimpose is indispensable at 0.9 or less [ of the mean amplitude of basic alternating current ].

[0043] Furthermore, when the superposition time amount of the high frequency current to superimpose is long, there needs to be evil to which a flicker becomes large conversely, and superposition time amount needs to be 1/4 or less [ of a half period ].

[0044]

[Effect of the Invention] The 1st effectiveness by this invention can aim at reduction of a flicker by making high electrode temperature in front of alternation as explained above.

[0045] When electrode temperature is made high in front of the alternation of alternating current, it is already well-known that an arc is stabilized by even after lamp current alternation and a flicker can be reduced. This well-known thing superimposes pulse current on the back end of alternating current in alternating current and this direction.

[0046] This invention has the means which can superimpose the high frequency current on the back end of alternating current in a change of pulse current, as shown in drawing 5 , and it can raise lamp electrode temperature, without affecting properties, such as a supply voltage to a lamp, and a life.

[0047] This invention reduces a flicker by forming RF generator 7 which drives a high frequency transformer 6 and it, and supplying the high frequency current for this means.

[0048] When the high frequency current flows in the same direction as a lamp current, lamp electrode temperature can rise, since the fall of temperature becomes slow due to a cooling

rate when flowing to hard flow, it does not fall to the original temperature, but by repeating this, the radix point of an arc when it can be made the temperature of hope and an electrode voltage polarity changes can be fixed, and a flicker can be reduced.

[0049] It is also acquired that the same effectiveness by this invention changes the location which superimposes a RF. According to this invention, it can perform easily superimposing the high frequency current on the location of not only the back end of an alternating current wave form but the back end, a tip, and arbitration.

[0050] Since the time amount radix point when it is not, and the electrode polarity will also have changed if the point that electrode temperature is high is generated during alternating current impression does not move just before an electrode polarity changes, there is same effectiveness to a flicker.

[0051] The 2nd effectiveness by this invention is the effectiveness of the high frequency current at the time of lamp lighting. That is, a \*\* case has much \*\* in DC current until a lamp is stabilized at the time of lamp lighting.

[0052] By superimposing not only DC but the high frequency current continuously for T hours synchronizing with pressure-lowering chopper actuating signal 4a at the time of lamp lighting of drawing 4 at this time, an electrical potential difference can be made low at the time of an IGUNAITO electrical potential difference and no-load.

[0053] This is for the feeble high frequency current's flowing in a lamp with the electrostatic capacity of a lamp, and urging ionization of the gas in a lamp. It is so clear that there is much existence of ionization ion in a lamp that an IGUNAITO electrical potential difference becomes low, and discharge sustaining voltage (at the time of no-load electrical potential difference) also falls.

[0054] Especially reduction of an IGUNAITO electrical potential difference has effectiveness in the miniaturization of equipment, and reduction of a noise source, and reduction of an electrical potential difference has effectiveness in the price of the component to be used, and the fall of loss at the time of no-load.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the block diagram of the alternating current ballast equipment of the gestalt of operation of this invention.

[Drawing 2] It is the block diagram of the pressure-lowering chopper of the alternating current ballast equipment of the gestalt of operation of this invention.

[Drawing 3] It is the block diagram of the full bridge switching circuit of the alternating

current ballast equipment of the gestalt of operation of this invention.

[Drawing 4] It is the timing diagram of the control signal of the control circuit of the alternating current ballast equipment of the gestalt of operation of this invention.

[Drawing 5] It is the output current wave form chart of the alternating current ballast equipment of the gestalt of operation of this invention.

[Description of Notations]

1 Pressure-Lowering Chopper

1a, 1b, 2a, 2b, 2c, 2d, 3a, 3b Terminal

2 Full Bridge Switching Circuit

3 Ignitor

4 Control Circuit

4a It is a pressure-lowering chopper actuating signal at the time of lamp lighting in the gestalt of the 1st operation.

Four b1 One tucking-up-its-sleeves-with-a-cord actuating signal of the 1st and the full bridge switching circuit in the gestalt of the 2nd operation

Four b2 The 1st and tucking-up-its-sleeves-with-a-cord actuating signal of another side of the full bridge switching circuit in the gestalt of the 2nd operation

4c1, 4c2 RF generator driving signal which superimposes the RF in the gestalt of the 2nd operation on the back end

4d RF generator driving signal which superimposes the RF in the gestalt of the 2nd operation at the back end and a tip

4e The RF generator driving signal which superimposes the RF in the gestalt of the 2nd operation on the location of arbitration

4f RF generator driving signal which superimposes the RF in the gestalt of the 2nd operation on the location of arbitration at intervals of one period

5 Lamp

6 High Frequency Transformer

7 RF Generator

11 Power-Source Line

12, 13, 14 Control line

21 FET

22 Flywheel Diode

23 Choke Coil

24 Capacitor

31,32,33,34 FET

5a, 5b, 5c, 5d, 5e Wave which superimposed high-frequency voltage and the high frequency current

51a, 51b, 51c, 51d, 51e RF superposition section